

# Middle Middle Miocene Structural Corsair (MM7 S1)

## Play *Cibicides opima* through *Bigenerina humblei* biozones

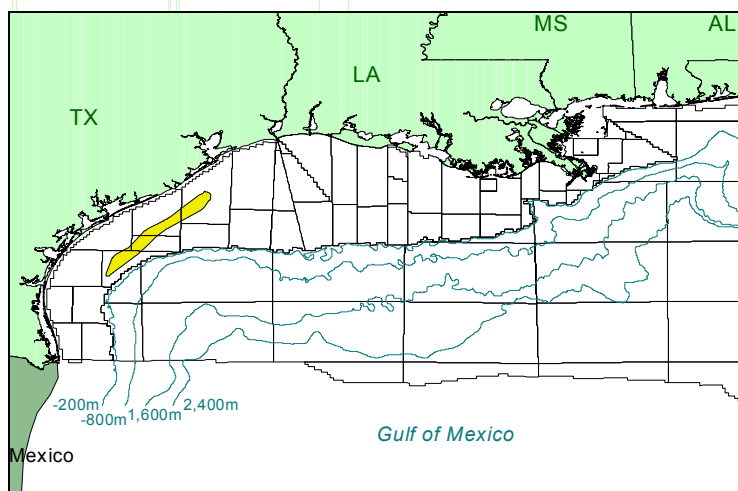


Figure 1. Play location.

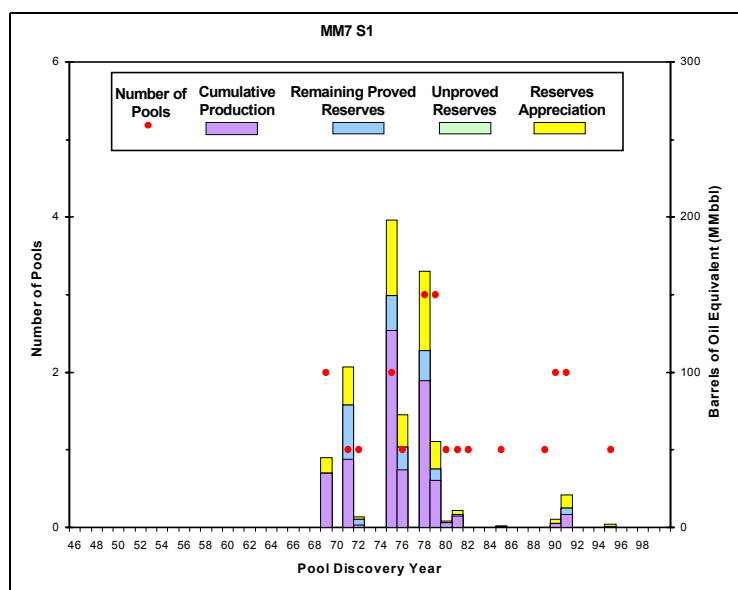


Figure 2. Exploration history graph showing reserves addition and number of pool discoveries by year.

MM7 S1 Play				
23 Pools 120 Sands	Minimum	Mean	Maximum	
Water depth (feet)	82	143	305	
Subsea depth (feet)	5904	9825	16460	
Number of sands per pool	1	5	15	
Porosity	17%	26%	33%	
Water saturation	16%	31%	44%	

Table 1. Pool attributes. Values are volume-weighted averages of individual reservoir attributes.

## Play Description

The established Middle Middle Miocene Structural Corsair (MM7 S1) play occurs within the *Cibicides opima*, *Cristellaria* "I," and *Bigenerina humblei* biozones. The play is defined by its structural position downthrown to the regional Corsair Fault System and by significant expansion of the MM7 section across the Corsair faults. The play extends in a narrow zone in offshore Texas from the Mustang Island East Addition Area northeastward to the central Galveston Area (figure 1). The MM7 S1 play is the largest of the three structurally defined plays (MM7 S1, MM9 S1, and MM7 S2).

The play is bounded updip by the regional extent of the Corsair Fault System. To the northeast, southwest, and downdip, the play is limited by the relatively thin, unexpanded sections of the Middle Middle Miocene Progradational (MM7 P1) and Middle Middle Miocene Fan 1 (MM7 F1) plays.

The MM7 S1 play is the deeper of two regional Corsair Fault System plays. The younger play is the Upper Middle Miocene (MM9 S1) play. Both plays are very similar in geographical and structural control; however, the MM7 S1 play is much more expanded across the Corsair Fault System, being up to 11,000 feet thick in comparison with a maximum thickness of only 3,800 feet for the MM9 S1 play. The MM7 S1 play also contains about 20 times the total endowment of the MM9 S1 play.

## Play Characteristics

The MM7 S1 play consists of stacked sequences of MM7 retrogradational, aggradational, progradational, and deep-sea fan sands that accumulated on the downthrown side of the Corsair Fault System. Movement on the Corsair Fault occurred in

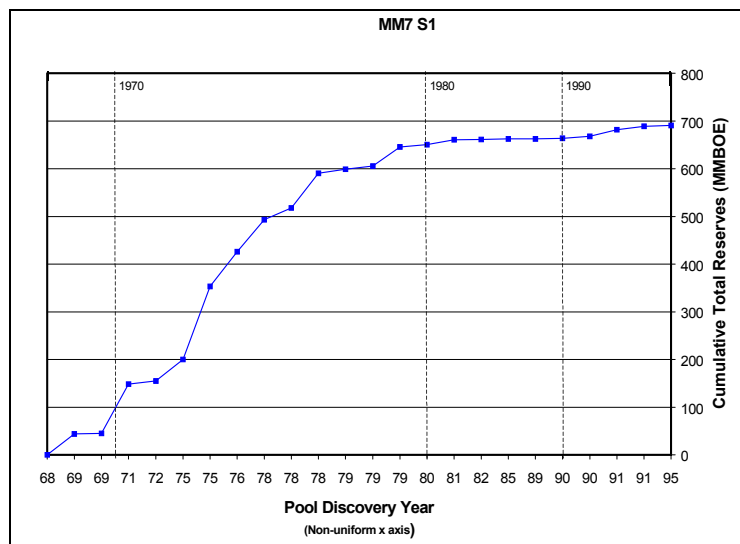


Figure 3. Plot of pools showing cumulative reserves by discovery order. Note the non-uniform x axis.

MM7 S1 Play Marginal Probability = 1.00	Number of Pools	Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
<b>Reserves</b>				
Original proved	23	0.009	2.760	0.500
Cumulative production	—	0.006	2.171	0.393
Remaining proved	—	0.003	0.589	0.107
Unproved	0	0.000	0.000	0.000
Appreciation (P & U)	—	0.004	1.050	0.190
<b>Undiscovered Conventionally Recoverable Resources</b>				
95th percentile	—	0.001	0.326	0.059
Mean	14	0.001	0.449	0.081
5th percentile	—	0.002	0.587	0.106
<b>Total Endowment</b>				
95th percentile	—	0.014	4.136	0.750
Mean	37	0.014	4.259	0.772
5th percentile	—	0.015	4.397	0.797

Table 2. Assessment results for reserves, undiscovered conventionally recoverable resources, and total endowment.

response to rapid influx of progradational and aggradational sands during periods of sea level lowstand, resulting in a greatly expanded MM7 S1 section. Reworking of progradational and aggradational sands during marine transgressions produced the retrogradational facies that locally occur within and at top of the section. Because sand accumulation was so influenced by movement along the fault system, the play is considered to be structurally controlled rather than depositionally controlled.

The Corsair Fault is only one of a series of growth fault systems that formed during the late Oligocene through the late Miocene in offshore Texas, but it is the most significant and well known because of the numerous hydrocarbon accumulations associated with it. Two structural styles are identifiable along the Corsair Fault System. In the Galveston Area, the main Corsair Fault has broken into a series of secondary relief or en echelon faults with traps formed on their upthrown sides. In the Mustang Island and Brazos Areas, large rollover anticlinal structures broken by antithetic faults developed on the downthrown side of the main Corsair Fault. Though the Corsair Fault is classified as a primary salt-withdrawal fault system with detachments into salt, its hanging walls overlie shale ridges (Bradshaw and Watkins, 1994). Hydrocarbon seals are provided by the juxtaposition of reservoir sands with shale, either structurally (e.g., faulting, diapirism) or stratigraphically (e.g., lateral shale-outs, overlying shales). The MM7 expanded section is overpressured in the Mustang Island and Brazos Areas.

## Discoveries

The MM7 S1 gas play contains total reserves of 0.013 Bbo and 3.810 Tcfg (0.691 BBOE), of which 0.006 Bbo and 2.171 Tcfg (0.393 BBOE) have been produced. The play contains 120 producible sands in 23 pools, of which all 23 contain proved reserves (table 1; refer to the

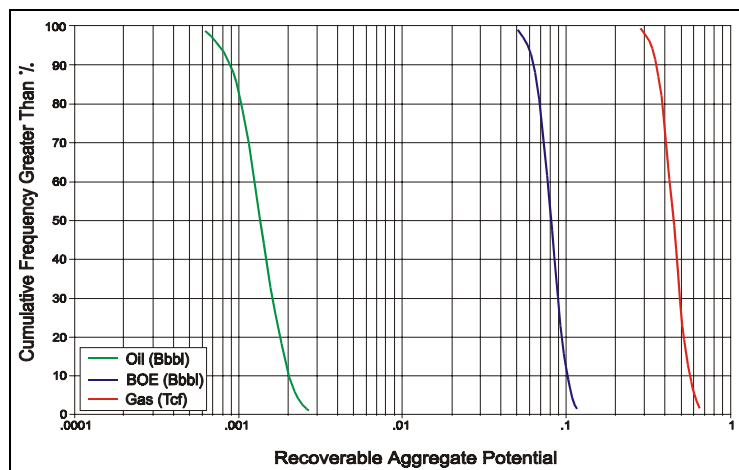


Figure 4. Cumulative probability distribution for undiscovered conventionally recoverable resources.

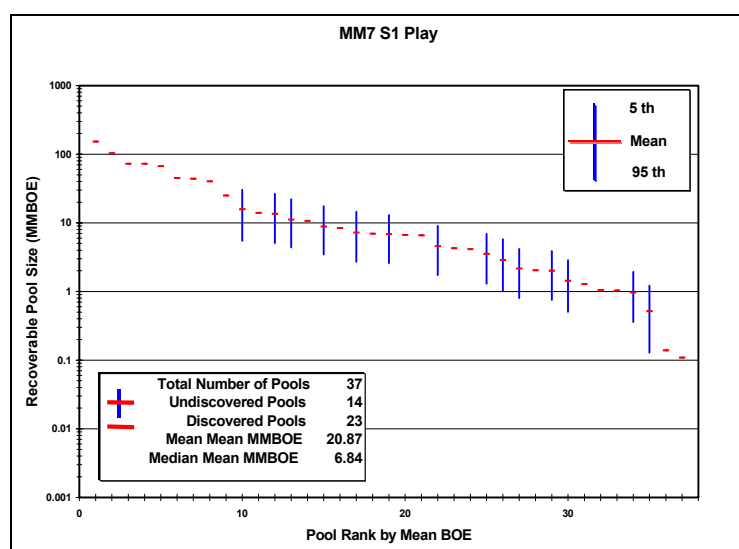


Figure 5. Pool rank plot showing the number of discovered pools (red lines) and the number of pools forecast as remaining to be discovered (blue bars).

Methodology section for a discussion of reservoirs, sands, and pools). The first reserves in the play were discovered in the Brazos 76A and Brazos 541 fields in 1969 (figure 2). Maximum yearly total reserves of 198 MMBOE were found in 1975 with the discovery of two pools, including the largest pool in the play (153 MMBOE) in the Brazos 133A field (figures 2 and 3). Discoveries peaked during the 1970's, during which 85 percent of the total reserves and over 80 percent of cumulative production were discovered. Ninety-seven percent of the play's cumulative production and 96 percent of the play's total reserves have come from pools discovered before 1990, reflecting the play's maturity. The most recent discovery, prior to this study's cutoff date of January 1, 1999, was in 1995.

The 23 discovered pools contain 216 reservoirs, all of which are nonassociated gas. The MM7 S1 play contains 95 percent of the combined total reserves in the MM7 S1 and MM9 S1 plays.

## Assessment Results

The marginal probability of hydrocarbons for the MM7 S1 play is 1.00. The play contains a mean total endowment of 0.014 Bbo and 4.259 Tcfg (0.772 BBOE) (table 2). Fifty-one percent of this BOE mean total endowment has been produced.

Assessment results indicate that undiscovered conventionally recoverable resources (UCRR) have a range of 0.001 to 0.002 Bbo and 0.326 to 0.587 Tcfg at the 95th and 5th percentiles, respectively (figure 4). Mean UCRR are estimated at 0.001 Bbo and 0.449 Tcfg (0.081 BBOE). These undiscovered resources might occur in as many as 14 pools. The largest undiscovered pool, with a mean size of 16 MMBOE, is forecast as the tenth largest pool in the play (figure 5). The forecast places the next four largest undiscovered pools in positions 12, 13, 15, and 17 on the pool rank plot. For all the undiscovered pools in the MM7 S1 play, the mean mean size is 6

MMBOE, which is smaller than the 30 MMBOE mean size of the discovered pools. The mean size for all pools, including both discovered and undiscovered, is 21 MMBOE.

The MM7 S1 is a mature play with a limited geographic

extent. BOE mean UCRR contribute only 10 percent to the play's BOE mean total endowment.

## Reference

Bradshaw, Barry E. and Joel S. Watkins. 1994. Growth-fault

evolution in offshore Texas: Gulf Coast Association of Geological Societies Transactions, vol. 44, p.103-110.